United Nations

Framework Convention on Climate Change

FCCC/TAR/2018/MNG

Distr.: General
1 April 2019

English only

Report of the technical assessment of the proposed forest reference level of Mongolia submitted in 2018

Summary

This report covers the technical assessment of the voluntary submission of Mongolia on its proposed forest reference level (FRL), in accordance with decision 13/CP.19 and in the context of results-based payments. The FRL proposed by Mongolia covers the activities "reducing emissions from deforestation", "reducing emissions from forest degradation" and "enhancement of forest carbon stocks", which are among the activities included in decision 1/CP.16, paragraph 70. For its submission, Mongolia developed a national FRL. The FRL presented in the original submission, for the reference period 2005–2015, corresponds to 5,165,536.8 tonnes of carbon dioxide equivalent per year (t CO_2 eq/year). As a result of the facilitative process during the technical assessment, the FRL was modified to 3,477,384.2 t CO_2 eq/year, mainly as a result of the exclusion of the soil organic carbon pool, in particular peatland areas. The assessment team notes that the data and information used by Mongolia in constructing its FRL are transparent, complete and in overall accordance with the guidelines contained in the annex to decision 12/CP.17. This report contains the assessed FRL and a few areas identified by the assessment team for future technical improvement, in accordance with the provisions on the scope of the technical assessment contained in the annex to decision 13/CP.19.

GE.19-05380(E)

1905380

Contents

		Paragraphs	*Page*
I.	Introduction and summary	1–14	3
	A. Overview	1–8	3
	B. Proposed forest reference level	9–14	4
II.	Data, methodologies and procedures used in the construction of the proposed forest reference level	15–44	5
	How each element in the annex to decision 12/CP.17 was taken into account in the construction of the forest reference level	15–44	5
III.	Conclusions	45–54	12
Annex			
	Summary of the main features of the proposed forest reference level based on information provided by Mongolia		15

I. Introduction and summary

A. Overview

1. This report covers the technical assessment (TA) of the submission of Mongolia on its proposed forest reference level (FRL),[1] submitted on 15 January 2018, in accordance with decisions 12/CP.17 and 13/CP.19. The TA took place (as a centralized activity) from 19 to 23 March 2018 in Bonn, Germany, and was coordinated by the UNFCCC secretariat.[2] The TA was conducted by two land use, land-use change and forestry experts from the UNFCCC roster of experts[3] (hereinafter referred to as the assessment team (AT)): Mr. Sabin Guendehou (Benin) and Mr. Craig Wayson (United States of America). In addition, Mr. Thiago de Araujo Mendes, an expert from the Consultative Group of Experts on National Communications from Parties not included in Annex I to the Convention, participated as an observer[4] during the centralized activity in Bonn. The TA was coordinated by Ms. Jenny Wong (UNFCCC secretariat).

2. In response to the invitation of the Conference of the Parties (COP) and in accordance with the provisions of decision 12/CP.17, paragraphs 7–15, and its annex, Mongolia submitted its proposed FRL on a voluntary basis. The proposed FRL is one of the elements[5] to be developed in the implementation of the activities referred to in decision 1/CP.16, paragraph 70. The COP decided that each submission of a proposed forest reference emission level (FREL) and/or FRL, as referred to in decision 12/CP.17, paragraph 13, shall be subject to a TA in the context of results-based payments, pursuant to decision 13/CP.19, paragraphs 1 and 2, and decision 14/CP.19, paragraphs 7 and 8.

3. In its submission, Mongolia explained that the objectives of its FRL are to access results-based payments in the future in accordance with the guidance of the Warsaw Framework for REDD-plus; assess the contribution of the forest sector towards fulfilling its nationally determined contribution to the Paris Agreement; and assess the impacts of REDD-plus[6] policies and measures implemented in the agriculture, forestry and land-use sector.

4. The objective of the TA is to assess the degree to which the information provided by Mongolia is in accordance with the guidelines for submissions of information on reference levels[7] and to offer a facilitative, non-intrusive, technical exchange of information on the construction of the FRL with a view to supporting the capacity of Mongolia for the construction and future improvement of its FREL/FRL, as appropriate.[8]

5. The TA of the FRL submitted by Mongolia was undertaken in accordance with the guidelines and procedures for the TA of submissions from Parties on proposed FRELs and/or FRLs.[9] This report on the TA was prepared by the AT following the same guidelines and procedures.

6. Following the process set out in those guidelines and procedures, a draft version of this report was communicated to the Government of Mongolia. The facilitative exchange during the TA allowed Mongolia to provide clarifications and additional information, which were considered by the AT in the preparation of this report.[10] As a result of the facilitative

[1] The submission of Mongolia is available at https://redd.unfccc.int/submissions.html?country=mng.
[2] Decision 13/CP.19, annex, paragraph 7.
[3] Decision 13/CP.19, annex, paragraphs 7 and 9.
[4] Decision 13/CP.19, annex, paragraph 9.
[5] Decision 1/CP.16, paragraph 71(b).
[6] In decision 1/CP.16, paragraph 70, the Conference of the Parties encouraged developing country Parties to contribute to mitigation actions in the forest sector by undertaking the following activities: reducing emissions from deforestation; reducing emissions from forest degradation; conservation of forest carbon stocks; sustainable management of forests; and enhancement of forest carbon stocks (decision 1/CP.16, para. 70).
[7] Decision 12/CP.17, annex.
[8] Decision 13/CP.19, annex, paragraph 1(a) and (b).
[9] Decision 13/CP.19, annex.
[10] Decision 13/CP.19, annex, paragraphs 1(b), 13 and 14.

interactions with the AT during the TA, Mongolia provided a modified version of its submission on 22 June 2018, which took into consideration the technical inputs of the AT.

7. Mongolia's modified submission is supported by nine appendices containing additional information on: land-use change matrices both for Intergovernmental Panel on Climate Change (IPCC) land-use categories and for national classes of forest and non-forest; statistical parameters such as the mean and the standard error of the sampling approach applied; the sampling approach used for the national forest inventory (NFI); forest cover change matrices for the reference period 2005–2015 and for each year of the reference period; estimates of deadwood biomass in intact and degraded boreal forest plots; and estimates of the total areas of forest and non-forest cover types for the reference period. Mongolia provided some of this additional information in the modified submission in response to the technical exchanges with the AT.

8. The modifications improved the clarity and transparency of the submitted FRL, without needing to alter the approach used to construct the proposed FRL. This report on the TA was prepared in the context of the modified FRL submission. The modified submission, containing the assessed FRL, and the original submission are available on the UNFCCC website.[11]

B. Proposed forest reference level

9. In decision 1/CP.16, paragraph 70, the COP encourages developing country Parties to contribute to mitigation actions in the forest sector by undertaking a number of activities, as deemed appropriate by each Party and in accordance with their respective capabilities and national circumstances, in the context of the provision of adequate and predictable support. The FRL proposed by Mongolia, on a voluntary basis, for a TA in the context of results-based payments, covers the three activities "reducing emissions from deforestation", "reducing emissions from forest degradation" and "enhancement of forest carbon stocks" (through reforestation/afforestation), which are three of the five activities included in decision 1/CP.16, paragraph 70. Pursuant to paragraph 71(b) of the same decision, Mongolia developed a national FRL covering its entire territory. For its submission, Mongolia applied a stepwise approach to the development of the FRL, in accordance with decision 12/CP.17, paragraph 10. The stepwise approach enables Parties to improve their FRL by incorporating better data, improved methodologies and, where appropriate, additional pools.

10. The FRL proposed by Mongolia for the historical reference period 2005–2015 is based on the net emissions from the annual average carbon dioxide (CO_2) emissions associated with "gross deforestation" (defined as the conversion of natural forest to other land-use categories) and "forest degradation" (defined as the loss of canopy cover from disturbance events such as fire, pests, logging and mining) and annual average removals associated with reforestation/afforestation. The proposed FRL is national in scope and includes all types of forests. The annual average net emissions, which are the sum of emissions from deforestation and forest degradation and removals from enhancement of forest carbon stocks (reforestation and/or afforestation) for the reference period, were estimated at 3,477,384.2 tonnes of carbon dioxide equivalent (t CO_2 eq). The difference between the value of the FRL in the modified submission and the FRL in the original submission is mainly due to the omission of the soil carbon pool.[12]

[11] See https://redd.unfccc.int/submissions.html?country=mng.

[12] In its original submission, Mongolia proposed a national FRL of 5,165,536.8 t CO_2 eq/year for the period 2005–2015. The emissions from deforestation and forest degradation amounted to 5,213,319 t CO_2 eq/year and removals from enhancement of forest carbon stocks amounted to –47,782 t CO_2 eq/year. The differences between the original and modified submission are mainly due to the recalculation of the removal factors and emission factors, while the activity data have remained the same; the increases in the removal factor values were due to the exclusion of the soil organic carbon pool in the modified submission. The modifications resulted in a decrease of approximately 32 per cent in the net emissions of the proposed FRL.

11. In response to a question raised by the AT on the consideration of carbon removals in forest land in the construction of the FRL, Mongolia clarified that it estimated the annual average removals from enhancement of forest carbon stocks from natural growth on forest land remaining forest land, which amounted to –29,158,201.4 t CO_2 eq. Mongolia explained that, to enhance transparency, these removals were not considered within the scope of the proposed FRL, and that, although growth in stable forests results in large removals, these removals are not expected to differ greatly in the results reporting period (i.e. only a minor negative impact on REDD-plus results is expected). Hence, Mongolia decided that the estimates that do not consider natural growth on forest land remaining forest land should be used for its proposed national FRL.

12. The information on the activity data used in constructing the FRL was extracted from the historical time series of land-use assessment plots (dot-grid samples) developed by the Climate Change Project Implementation Unit within the Ministry of Environment and Tourism for the years 2005–2015. Annual land-use change estimates were derived from an analysis of 123,472 dot-grid samples.[13] The information used to develop the emission factors was obtained from Mongolia's multipurpose NFI carried out from 2014 to 2016; additional information on disturbed and/or low-stocked forests was collected in 2017, covering boreal forests only.

13. The proposed FRL includes four carbon pools: above-ground biomass; below-ground biomass; deadwood and litter. Regarding greenhouse gases (GHGs), the FRL includes CO_2 only.

14. Mongolia did not apply an adjustment to its FRL calculation. However, the Party clearly reported a number of national circumstances, such as increased severity of winters, prolonged dry seasons, modified rainfall patterns, and glacier and permafrost thawing, that may lead to changes in vegetation growth and forest health. During the TA, Mongolia confirmed that these national circumstances may have an impact on future forest emissions and that it continues to evaluate them. Mongolia also explained that, at this point in time, it does not intend to apply an adjustment to the construction of its FRL.

II. Data, methodologies and procedures used in the construction of the proposed forest reference level

How each element in the annex to decision 12/CP.17 was taken into account in the construction of the forest reference level

1. Information that was used by the Party in the construction of the forest reference level

15. For the construction of the FRL, Mongolia used the gain-loss method from the *2006 IPCC Guidelines for National Greenhouse Gas Inventories*[14] (hereinafter referred to as 2006 IPCC Guidelines) to estimate the changes in carbon stocks in the selected carbon pools (above-ground biomass, below-ground biomass, deadwood and litter). For assessing the carbon stock changes in the biomass pool, Mongolia applied country-specific allometric models for above-ground biomass, and used relevant data from the NFI collected between 2014 and 2016, as well as relevant default data from the 2006 IPCC Guidelines. Emission factors for living biomass, deadwood and litter were derived from the NFI. Soil organic carbon was not considered by Mongolia in the construction of its modified FRL owing to a lack of data.

16. The emission factors were developed for each carbon pool and each of the selected activities. During the TA, the AT noted that Mongolia did not provide sufficient information in its original submission to facilitate an understanding of how the emission factors were

[13] Of the 123,577 samples assessed, 105 were omitted from the analysis owing to cloud cover.

[14] IPCC. 2006. *2006 IPCC Guidelines for National Greenhouse Gas Inventories*. S Eggleston, L Buendia, K Miwa, et al. (eds.). Hayama, Japan: Institute for Global Environmental Strategies. Available at https://www.ipcc-nggip.iges.or.jp/public/2006gl.

calculated. In response, Mongolia shared with the AT the spreadsheets containing the data used to calculate the emission factors. The AT notes that this additional information shared by Mongolia enhanced its understanding of the matter. In the modified submission, Mongolia provided details of the sampling approach used during the NFI to collect forest statistics and information for deriving the emission factors. According to Mongolia, the emission factors were derived from biomass values of above-ground and below-ground biomass and deadwood generated from 4,080 NFI plots that were further aligned with the Collect Earth[15] study.

17. The activity data, representing each of the IPCC land-use categories, were generated using 123,577 virtual plots of 1 ha with a varying sample density[16] available from Collect Earth. This process was used to identify areas of forest cover loss, forest cover gain and forest disturbance in the period 2005–2015. The principal imagery examined by each interpreter was the Landsat greenest pixel composites at 30 m resolution. Ancillary imagery provided by Google Earth and Bing Maps was also used where available. The AT noted that the original submission did not describe clearly the entire process, consisting of sampling design, data collection and analysis, and requested further clarification from Mongolia. In the modified submission, Mongolia provided a much clearer description of the process, thereby enhancing the transparency of the submission and helping the AT to better understand the approach used.

18. Although Mongolia explained that the FRL is national in scope and includes all types of forests (see section 1.3.1 of the modified submission), the estimated emissions and removals were for boreal forests only, located mainly in the northern part of the country which has the most forested areas. The estimates do not include emissions and removals from the saxaul forests in the southern part of the country (see para. 20 below).

2. Transparency, completeness, consistency and accuracy of the information used in the construction of the forest reference level

Methodological information, including description of data sets, approaches and methods

19. Mongolia reported in its original submission that natural growth of forests was not included in the construction of its FRL and that the proposed FRL considers only losses due to disturbances from fire, pests and logging activities, identified from the activity data from Collect Earth.[17] The AT is of the view that in the original submission, in which the gain-loss method was applied, the biomass growth values applied may not have been in line with the guidance of the 2006 IPCC Guidelines, and, hence, may have resulted in a higher FRL value. The AT suggested that Mongolia use the default values provided in table 4.9 of the 2006 IPCC Guidelines (volume 4, chapter 4, pp.4.57 and 4.58) if country-specific data on biomass growth were not available. In response, in its modified submission Mongolia applied IPCC equations 2.9 and 2.10 and the IPCC default parameters on average annual above-ground biomass growth, root-to-shoot ratio and carbon fraction to estimate the annual gain in biomass stocks (see chapter 2, p.2.15, and chapter 4, tables 4.3, 4.4 and 4.9 of the 2006 IPCC Guidelines). The AT commends Mongolia for this methodological improvement. However, the AT identified as an area for technical improvement the development of country-specific tree growth values for each forest type in order to improve the accuracy of the estimates calculated using the gain-loss method.

20. According to the modified submission, Mongolia used a systematic sampling approach to establish the 4,284 sampling units that were inventoried in its NFI (1,007 sample units for the national square grid (9 km × 9 km) and 3,277 sample units for an intensified grid). Each sampling unit is a cluster of three sample plots. As a result, 12,216 sample plots were measured during the NFI and the data collected were used to calculate the emission factors and removal factors for each carbon pool. Mongolia reported that the sample locations

[15] Collect Earth is a free and open-source software for land monitoring developed by the Food and Agriculture Organization of the United Nations together with Google Earth, Bing Maps and Google Earth Engine. For further information, see http://www.openforis.org/tools/collect-earth.html.

[16] The sample density was based on two strata: boreal forest and other areas.

[17] Mongolia shared the following video with the AT to demonstrate how such disturbances were assessed using the Collect Earth tool: https://www.youtube.com/watch?v=NacYYeYCFKM.

were selected using forest masks (forest/non-forest maps) from the years 2013 and 2015 that covered the dominant well-stocked forest areas in the boreal forest zone (canopy cover greater than 66 per cent). Additional data for low-stocked forest were collected on 156 new NFI plots that were measured in 2017 following the same methodology to ensure consistency with the national forest definition (i.e. canopy cover threshold of 10 per cent). Mongolia provided a description of the steps used to calculate the emission factors in its modified submission in response to the technical exchange of views with the AT. Mongolia clarified that none of the NFI plots were located in saxaul forests and shrub and, therefore, no emission factors and removal factors were estimated for these vegetation classes. In addition, Mongolia clarified that activity data were collected for saxaul forests and shrub, and it was found that there were no significant net carbon losses or gains in these forest types. Therefore, emissions were assumed and reported as zero. The AT notes that Mongolia identified the improvement of the estimates of changes in carbon stocks in saxaul forest and shrub as part of its future FRL construction (see chapter 5 of the modified submission).

21. The AT, in its analysis of the data sets provided by Mongolia, determined that Mongolia assumed that carbon in all pools is lost (instantaneous oxidation), with the exception of the soil pool in the case of conversions of intact forest to degraded forest or to non-forest (which is grassland in Mongolia). Mongolia considered that there is no change in the soil pool in these conversions. This assumption of instantaneous oxidation would lead to higher emissions and, thus, to a higher FRL value. Taking into consideration the carbon remaining or available through regrowth after the conversion of intact forest to degraded forest and to non-forest in Mongolia's estimates for the construction of future FRLs was identified by the AT as an area for technical improvement.

22. During the TA, Mongolia clarified that for the conversion of non-forest to intact forest it considered the changes in carbon stocks in all carbon pools, except for soil. For the conversion of non-forest to degraded forest (also considered as enhancement), only the changes in carbon stocks in above-ground biomass were reported. For the calculation of the carbon stock changes in conversion to degraded forest, Mongolia used the above-ground biomass of intact forest. The AT notes that this would lead to higher removals. The AT identified as an area for technical improvement the estimation of above-ground biomass specific to degraded forest.

23. The above-ground biomass stock component of the emission factors was estimated by applying the allometric models for biomass developed by the Institute of General and Experimental Biology of the Mongolian Academy of Sciences. The models applied were power functions that used two variables: diameter at breast height and total tree height. During the TA, Mongolia provided documentation on the NFI[18] and the findings on above-ground biomass estimates in boreal forests by Dorjsuren[19] which described how the allometric models were developed. In its modified submission, Mongolia added new information on sample size (192 selected trees compared to 142 reported in the original submission), corresponding to 19 tree species (compared to 7 tree species in the original submission) and a reference[20] to support the approach used for the development of the allometric models. From the information provided, the AT identified that a destructive sampling approach was implemented to develop the allometric equations. Given the large area of forests in Mongolia, the AT is of the view that the sample size will need to be increased in order to improve the quality and accuracy of the allometric models. The AT notes that its view on increasing the sample size is in line with the findings of Dorjsuren. The AT identified the increase in sampling size for adequate allometric model development as an area for future technical improvement. During the TA, Mongolia clarified that it used the

[18] Ministry of Environment and Tourism. 2016. *Mongolian Multipurpose National Forest Inventory 2014–2016* (1st edition). Ulaanbaatar, Mongolia: Ministry of Environment and Tourism. Available at http://forest-atlas.mn/.

[19] Dorjsuren C. 2017. *Estimation of Above-ground Biomass and Carbon Stock in Mongolian Boreal Forest*. Ulaanbaatar, Mongolia: Deutsche Gesellschaft für Internationale Zusammenarbeit.

[20] Picard N, Laurent SA and Henry M. 2012. *Manual for Building Tree Volume and Biomass Allometric Equations: From Field Measurement to Prediction*. Rome, Italy: Food and Agriculture Organization of the United Nations, and Montpellier, France: Centre de Coopération Internationale en Recherche Agronomique pour le Développement.

appropriate default values for boreal forests provided in the 2006 IPCC Guidelines for two parameters: the root-to-shoot ratio (0.39 and 0.24 t root d.m. (t shoot d.m.)$^{-1}$) and the carbon fraction value (0.51 t C (t d.m.)$^{-1}$).[21] All other parameters (e.g. wood densities, biomass expansion factors) were country-specific, the values being derived from the NFI.

24. In addition, the AT notes that, based on the information provided in Mongolia's submission, it could not verify whether the allometric models were properly applied. During the TA, Mongolia provided examples of how the biomass stocks in living biomass in the sample plots were calculated. This improved the transparency of the estimation of changes in biomass carbon stocks.

25. The plots used for biomass measurements were also used to measure deadwood, including standing dead trees and deadwood on the ground. The NFI indicated that the contribution of deadwood to the wood volume in boreal forest is 40 per cent. This confirms that the deadwood pool is a significant pool that needs to be taken into consideration for the calculation of the FRL. The figures reported by Mongolia in its NFI also confirm that the inclusion of the litter pool improved the estimation of changes in carbon stocks resulting from deforestation and thus improved the accuracy of the FRL estimate.

26. The FRL of Mongolia contains information on the uncertainty associated with the emission factors and activity data. However, in its original submission Mongolia did not report information on the combined uncertainty of the emission and removal factors and the emissions and removals associated with the FRL. The AT is of the view that the information from such an uncertainty assessment may help Mongolia to prioritize areas where resources and efforts are needed to improve future submissions. In the modified submission, Mongolia clarified that simple error propagation equations provided in the IPCC *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*[22] were applied, resulting in an uncertainty value associated with emissions of 18 per cent. The AT noted that Mongolia should provide an explanation of and documentation on how the uncertainties were combined as an area for technical improvement in future submissions.

27. The AT noted that in the land-use change matrix there were no values for the conversion of forest to cropland. During the TA, Mongolia clarified that there were no conversions of forest to cropland in the FRL period. In addition, Mongolia explained that, if such conversions had occurred, the methodology used would have detected them. The AT suggested that Mongolia may wish to consider indicating in the land-use change matrix that such conversions were not occurring, for example by reporting a zero value to indicate that there was no change.

28. According to decision 12/CP.17, paragraph 8, and decision 13/CP.19, annex, paragraph 2(a), a proposed FREL/FRL should maintain consistency with the corresponding anthropogenic forest-related GHG emissions by sources and removals by sinks contained in a country's national GHG inventory. However, the AT could not find sufficient information in Mongolia's first biennial update report (BUR)[23] that would allow the AT to check for consistency between the reported emissions due to deforestation (intact forest to non-forest) and removals related to enhancement of forest carbon stocks (non-forest to intact forest and non-forest to degraded forest) used in the construction of the FRL and the GHG emission estimates associated with forest land converted to other land-use categories and land-use categories converted to forest land in the BUR. In addition, the AT noted that Mongolia reported in its BUR the emissions and removals from all forest types, including boreal and saxaul forests, while for the calculation of the FRL, it considered only boreal forests. During the technical exchange of views, Mongolia clarified that saxaul forests were in fact included in the construction of the FRL (see para. 20 above). In addition, the FRL was constructed based on new and improved data generated using the Collect Earth tool. Furthermore, Mongolia emphasized during the TA that the activity data representing the land area

[21] See tables 4.3 and 4.4 of the 2006 IPCC Guidelines (volume 4, chapter 4).

[22] IPCC. 2000. *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*. J Penman, D Kruger, I Galbally, et al. (eds.). Hayama, Japan: IPCC/Organisation for Economic Co-operation and Development/International Energy Agency/Institute for Global Environmental Strategies. Available at http://www.ipcc-nggip.iges.or.jp/public/gp/english/.

[23] Mongolia's first BUR is available at https://unfccc.int/documents/180667.

generated using the Collect Earth tool were not used in the calculation of emissions and removals in the national GHG inventory. In order to improve consistency between the FRL estimates and the estimates contained in its GHG inventories in the future, Mongolia reported in its BUR that the activity data from Collect Earth will be used to calculate the estimates for future GHG inventories, which will include all land-use categories.[24] The AT identified the need to maintain consistency between the methodologies and data used in Mongolia's FRL and its GHG inventories as an area for future technical improvement.

29. The AT notes that the Collect Earth method used for generating activity data was clearly described in the submission and commends Mongolia for providing this substantive description. Likewise, the Party estimated carefully the sampling density required to meet the criteria based on previously existing data provided through Global Forest Watch.[25] Once the exercise was completed, Mongolia chose to use a regularly spaced sample grid with two sample densities: 2.25 km × 2.25 km in areas that could contain boreal forests and 9 km × 9 km for other areas. These grids are arranged such that they allow for the sample size to be increased in the future if required for data needs. The AT notes that no clear justification was provided as to why Mongolia is of the view that the 9 km × 9 km grid is sufficient for areas outside of boreal forests. The AT identified the addition of this justification as an area for future technical improvement to ensure transparency. Given the differing sample point densities and the size of the country, it is necessary to estimate expansion factors for the sample points: these values were provided by Mongolia in table 2-1 of the modified FRL submission. However, the AT considers that the specific calculations used should also be included in the submission to increase transparency. The AT notes that the modified submission does not include an explanation as to why Mongolia considered that it was not important to also track other forest types with higher precision.

30. The survey design form used for collecting the spatial data included 1 ha square-shaped plots. This plot size differs from the NFI plot size but is consistent with the minimum size as defined in Mongolia's forest definitions. These plots contained 49 subplots as sampling points, corresponding to approximately 2 per cent of each 1 ha square-shaped sample plot. The number of subplots or grid points in each of the six land-use categories was recorded and land cover was assessed based on hierarchical criteria and as a percentage of the area in the plot. The six land cover types were assessed within each sample through an expert image interpretation of medium to very high spatial resolution aerial and satellite imagery.

31. The AT is of the view that the process for assessing forest disturbance was not clearly explained (e.g. how the sample design is consistent with the NFI (see para. 30 above)) and that describing it more clearly would improve transparency. This is especially important as the area of forest degradation, as estimated in the FRL, is 26 times greater than the area of forest cover loss. During the TA, Mongolia provided more information on how disturbance was measured and showed more clearly how the emission factor estimates were linked to the activity data estimates (see also para. 19). In the modified submission, the calculations of how the emission factors were determined were much clearer. However, more discussion beyond the mention that degraded plots were determined by the operator's interpretation is identified by the AT as an area for future technical improvement.

32. The description of the response design provided in the submission cites relevant good practice guidance from the Global Observation for Forest Cover and Land Dynamics[26] and the IPCC used by the Party to increase accuracy and minimize errors. Mongolia also stated that the image selection has sufficient temporal and spatial resolution for data collection. Mongolia further mentioned in its submission that the response design allowed the interpreter

[24] In its first BUR (table 6-4, p.99), Mongolia expressed its intention to include in future GHG inventories all six land categories and land-use changes between those categories using improved data sources, such as the Collect Earth tool.

[25] Further information on Global Forest Watch is available at http://www.globalforestwatch.org/.

[26] Global Observation for Forest Cover and Land Dynamics. 2015. *A Sourcebook of Methods and Procedures for Monitoring and Reporting Anthropogenic Greenhouse Gas Emissions and Removals Associated with Deforestation, Gains and Losses of Carbon Stocks in Forests Remaining Forests and Deforestation*. Wageningen, the Netherlands: GOFC-GOLD Land Cover Project Office hosted by Wageningen University.

to estimate with confidence the land cover determination. The AT notes that the specific steps taken by the Party in following the good practice guidance were not described in the submission and identified this as an area for future technical improvement to ensure transparency.

33. On completion of data collection, Mongolia analysed the data following the guidelines provided by the Global Forest Observation Initiative[27] and the sample-based estimates were calculated in the R-statistics platform using the survey package developed by Lumley in 2004 and 2014.[28] Appendix 2 to the modified submission presents the equations used. The AT finds that this section would benefit from more specific information on how the equations were applied by the Party, including the values used, in order to improve transparency. The inclusion of this information would be useful since the equations in appendix 2 are for a generalized approach and do not apply specifically to the design selected by Mongolia. During the TA, Mongolia shared with the AT the data and code in the R-statistics platform used for the calculations, thereby allowing the AT to examine the accuracy of these calculations. In the original submission, the AT noted that the estimates of activity data only show uncertainties associated with sample error. The modified submission included an analysis of uncertainty for the activity data and showed a 93 per cent consistency with the original analysis using independent interpreters. The inclusion of fully propagated errors (e.g. sample error, interpreter error) was identified by the AT as an area for future technical improvement.

34. The AT commends Mongolia for providing detailed estimates for land use and/or land cover for three periods (2005, 2010 and 2015), as well as annual estimates for forest cover loss and gain. However, during the TA, the AT learned that the actual estimates of activity data used for construction of the FRL were for the period 2005–2015 and annualized over the 10-year period. In addition, during the TA, the AT learned that the final activity data estimates used for the calculation of the FRL included only boreal forest, as Mongolia indicated that no changes were found in the saxaul forest type. The AT notes that, in the modified submission, the data for saxaul forest were not included but the Party mentioned that the percentage change in the area of this forest type is so low that it is difficult to estimate. For transparency purposes, the AT suggests that Mongolia include the emission and removal estimates for saxaul forests in future FRL submissions to clearly show that there is no change.[29]

Description of relevant policies and plans, as appropriate

35. In accordance with decision 12/CP.17, annex, subparagraph (b), a Party should provide descriptions of relevant policies and plans as part of its submission on its proposed FREL and/or FRL. The AT notes that Mongolia did not specifically provide such information in its submission. The AT sought more clarification from Mongolia on this omission of information. In response, during the TA Mongolia shared with the AT information that clearly showed the relevant policies that apply to the FRL. Mongolia included a detailed description of the relevant policies in chapter 4 of its modified submission, noting that it has developed several policies that support its REDD-plus strategic objectives, including the Green Development Policy (2014), the State Policy on Forests (2015), the National Biodiversity Programme 2015–2025, the Sustainable Development Vision (2016) and the National Action Plan for the State Forest Policy (2017).

[27] Global Forest Observation Initiative. 2016. *Integrating Remote-sensing and Ground-based Observations for Estimation of Emissions and Removals of Greenhouse Gases in Forests: Methods and Guidance from the Global Forest Observation Initiative*. Edition 2.0. Rome, Italy: Food and Agriculture Organization of the United Nations.

[28] Lumley T. 2004 and 2014. Analysis of complex survey samples. Available at http://r-survey.r-forge.r-project.org/survey/.

[29] Mongolia informed the AT that a study on saxaul forest emission and removal factors is ongoing (see chapter 5, section 5.1, of the modified submission).

3. Pools, gases and activities included in the construction of the forest reference level

36. According to decision 12/CP.17, annex, subparagraph (c), reasons for omitting a pool and/or activity from the construction of the FREL and/or FRL should be provided, noting that significant pools and/or activities should not be excluded.

37. The pools included in Mongolia's FRL are above-ground biomass, below-ground biomass, deadwood and litter for the activities "reducing emissions from deforestation" and "reducing emissions from forest degradation", and above-ground biomass and below-ground biomass for the activity "enhancement of forest carbon stocks". Mongolia applied the IPCC tier 1 approach assuming that there are no changes in soil organic carbon during all land-use conversions.

38. For the conversions of non-forest to degraded forest, Mongolia assumed that the degraded forests are young forests containing small amounts of deadwood and litter. In the submission, Mongolia highlighted that it will include emissions or removals from soil organic carbon, in particular peatland areas, as one of the areas for future improvement. Mongolia also reported in its submission that it collected soil and litter samples during the NFI for degraded and low-stocked forests. These samples will be analysed in order to include the soil and litter pools in future submissions. The AT considers that the exclusion of the soil and litter pools was adequately justified by Mongolia and commends its efforts to obtain better information on these pools, with the aim of including them in future submissions as part of the stepwise approach. Recognizing that data on these two pools will be available, the AT identified as an area for future technical improvement the inclusion of the litter and soil organic carbon pools for all land-use conversions and, in particular, for the conversion of non-forest to degraded forest.

39. For all four carbon pools, Mongolia included only CO_2 emissions resulting from deforestation and forest degradation. Non-CO_2 GHG emissions were not included in the construction of Mongolia's FRL. The AT noted that nitrous oxide (N_2O) emissions from mineralization of organic matter following deforestation may be a significant source. Mongolia informed the AT that initial studies have been carried out on the relative importance of non-CO_2 emissions, including methane (CH_4) emissions from the impact of deforestation and forest degradation on the permafrost layer, and N_2O emissions from degraded forest as a result of forest fires. Mongolia confirmed during the TA that further work is required to develop data that would allow these non-CO_2 gases to be included in future FRL submissions. The AT considers the treatment of non-CO_2 gases as an area for future technical improvement.

40. Mongolia mentioned in its submission that CO_2 removals in forest land remaining forest land are considered as part of the activity "enhancement of forest carbon stocks" and have therefore been included in the FRL in order to ensure completeness and maintain consistency with the GHG inventory. Mongolia further explained that the inclusion of these removals is not expected to have a significant impact on the results that will be reported later.

41. The AT acknowledges that Mongolia included the most significant activities (i.e. "reducing emissions from deforestation", "reducing emissions from forest degradation" and "enhancement of forest carbon stocks") of the five activities identified in paragraph 70 of decision 1/CP.16, in accordance with its national capabilities and circumstances. Mongolia explained in its FRL submission that afforestation and reforestation activities are considered under the activity "enhancement of forest carbon stocks". Mongolia also explained that separate calculations were not done for the activities "conservation of forest carbon stocks" and "sustainable management of forests" as the impacts of these two activities were considered to be covered by the selected activities. Although this approach does not affect the estimation of the emissions and removals reported by Mongolia, the AT notes that the separate treatment of all five REDD-plus activities enhances transparency with regard to the allocation of emissions and removals to each of the selected activities.

42. Overall, the AT commends Mongolia for the information relating to carbon pools, GHGs and the selected activities provided in its submission. The AT acknowledges the intention expressed by Mongolia to include additional carbon pools (soil and litter) and non-CO_2 gases in future submissions when new, adequate data and better information become available as part of the stepwise approach.

4. Definition of forest

43. Mongolia provided in its submission the definitions of boreal and saxaul forest used in the construction of its FRL. These definitions are not the same as those used by the Party for its national GHG inventory or its reporting to the Food and Agriculture Organization of the United Nations (FAO) as part of the Global Forest Resources Assessment (FRA). The definition of boreal forest applied in the FRL is all land with a minimum area of at least 1 ha covered by trees, with a tree height of 2 m or a potential to reach this height and with a minimum canopy cover of 10 per cent. For saxaul forest, the definition presented in the FRL is a minimum area of 1 ha and at least 4 per cent canopy cover. The minimum potential tree height was not defined owing to difficulties in estimating the height through the use of the Collect Earth tool.

44. The AT noted discrepancies between the two definitions applied in the FRL and the forest definitions used by Mongolia in its GHG inventory and in its reporting to FAO as part of the FRA. Mongolia explained that it used the definition of forest land for the purposes of its taxation forest inventory in its reporting to FAO under the FRA. The technical working group for the national forest monitoring system and FRL development decided to revise the minimum tree height from 5 m to 2 m and the minimum area from 0.5 ha to 1 ha (the former thresholds were used for FRA reporting), which allowed for the inclusion of some forest tree species (for tree height) and adaptation to the specifications of the Collect Earth tool (for minimum area). The AT considers it important that Mongolia provide a clearer justification as to why and how the definitions used were chosen, in accordance with decision 13/CP.19, annex, paragraph 2(g), and include future steps to address the differences between the definitions used for the FRL and those applied in its reporting under other processes. In the modified submission, Mongolia explained that the definition of forest (for boreal forest areas) was "all land spanning of at least 1 ha covered by trees with a height of at least 2 m and with a canopy cover of at least 10 percent" and that this definition was applied in the construction of the FRL and will also be used in other national and international submissions in the future.

III. Conclusions

45. The information used by Mongolia in constructing its FRL for the activities "reducing emissions from deforestation", "reducing emissions from forest degradation" and "enhancement of forest carbon stocks" is transparent, complete and in overall accordance with the guidelines for submission of information on reference levels (as contained in the annex to decision 12/CP.17).

46. The FRL presented in the modified submission corresponds to 3,477,384.2 t CO_2 eq/year for the reference period 2005–2015.

47. The AT acknowledges that Mongolia included in the FRL the most significant activities and the most significant pools in terms of emissions and removals from forests. In doing so, the AT considers that Mongolia followed decision 1/CP.16, paragraph 70, on activities undertaken, and decision 12/CP.17, paragraph 10, on implementing a stepwise approach. The AT commends Mongolia for the information provided on the ongoing work relating to the development of future FRLs and include non-CO_2 gases, additional carbon pools and saxaul forests as part of the FRL.

48. As a result of the facilitative interactions with the AT during the TA, Mongolia provided a modified submission, which took into consideration the technical inputs of the AT. The AT notes that the transparency and completeness of information was improved significantly in the modified FRL submission and commends Mongolia for the efforts made. The new information provided in the modified submission, including the NFI sampling design, the data collection and the approach applied for the calculation of the emission factors, increased the reproducibility of the FRL calculations.

49. The AT notes that, overall, the FRL does not maintain consistency, in terms of sources of activity data and emission factors and the forest definition, with the GHG inventory

included in Mongolia's first BUR. This inconsistency is due to the use of new and improved data for the FRL, which will be used in the next BUR submission to ensure consistency.[30]

50. Pursuant to decision 13/CP.19, annex, paragraph 3, the AT identified the following areas for future technical improvement:

(a) Develop country-specific tree growth values for each forest type in order to improve the accuracy of the estimates from the gain-loss method (see para. 19 above);

(b) Take into consideration the carbon remaining or available through regrowth after the conversion of intact forest to degraded forest and to non-forest in future FRLs (see para. 21 above);

(c) Estimate above-ground biomass specific to degraded forest (see para. 22 above);

(d) Increase the sampling size to improve the quality and accuracy of the development of allometric models (see para. 23 above);

(e) Provide an explanation of and documentation on how the uncertainties for the emission factors and activity data were combined (see para. 26 above);

(f) Maintain consistency between the FRL and future GHG inventories in terms of methodologies and data used (see para. 28 above);

(g) Provide justification as to why the use of a 9 km × 9 km grid is sufficient for monitoring areas outside of boreal forests as well as the specific calculations used for estimating the expansion factors (see para. 29 above);

(h) Provide more detailed information on the process for assessing forest disturbance (see para. 31 above);

(i) Provide a more detailed description of the steps taken to increase accuracy and minimize errors in land cover determination, following the good practice guidance from the Global Observation for Forest Cover and Land Dynamics and the IPCC (see para. 32 above);

(j) Include fully propagated errors for activity data (see para. 33 above);

(k) Include verifiable information on changes in land areas, including the emissions and removals from saxaul forests, to demonstrate that there are no changes in saxaul forest areas and the associated carbon stocks in these areas (see para. 34 above).

51. In assessing the pools and gases included in the FRL, pursuant to decision 13/CP.19, annex, paragraph 2(f), the AT notes that the current omissions of pools and gases are likely to be conservative in the context of the FRL. Nevertheless, the AT identified the following additional areas for future technical improvement:

(a) Include soil organic carbon pools for all land-use conversions and, in particular, the conversion of non-forest to degraded forest (see para. 38 above);

(b) Include emissions or removals from soil organic carbon, in particular peatland areas (see para. 38 above);

(c) Consider non-CO_2 GHG emissions, such as CH_4 emissions from the permafrost layer as a result of deforestation and N_2O emissions from forest fires (see para. 39 above).

52. The AT acknowledges and welcomes the intention expressed by Mongolia to:

(a) Include the emissions and removals from saxaul forests in future FRLs by setting up permanent sampling plots, developing methods for mapping and emission factors, and monitoring such forests;

(b) Include emissions or removals from soil organic carbon, especially in peatland areas;

[30] In reference to the scope of the TA, see decision 13/CP.19, annex, paragraph 2(a).

(c) Undertake a comprehensive uncertainty analysis using the Monte Carlo approach;

(d) Estimate the proportion of biomass loss from disturbance events so as to determine the level of decay or oxidation in trees;

(e) Include non-CO_2 gases, including CH_4 emissions resulting from the impact of deforestation and forest degradation on the permafrost layer and N_2O emissions from forest fires.

53. In conclusion, the AT commends Mongolia for showing a strong commitment to the continuous improvement of its FRL estimates in line with the stepwise approach. A number of areas for future technical improvement of Mongolia's FRL have been identified in this report. At the same time, the AT acknowledges that such improvements are subject to national capabilities and policies, and notes the importance of adequate and predictable support.[31] The AT also acknowledges that the assessment process was an opportunity for a rich, open, facilitative and constructive technical exchange of information with Mongolia.

54. The table contained in the annex summarizes the main characteristics of Mongolia's proposed FRL.

[31] Decision 13/CP.19, annex, paragraph 1(b), and decision 12/CP.17, paragraph 10.

Annex

Summary of the main features of the proposed forest reference level based on information provided by Mongolia

Main features of the FRL		*Remarks*
Proposed FRL (in t CO_2 eq/year)	3 477 384.2	The proposed FRL covers the net emissions from the annual average CO_2 emissions associated with gross deforestation and forest degradation and annual average removals from reforestation and afforestation (see paras. 10 and 11 of this document)
Type and duration of FRL	Historical emissions/removals over the period 2005–2015	The FRL proposed by Mongolia includes emissions from deforestation and forest degradation and removals from enhancement of forest carbon stocks (considered as afforestation/reforestation by Mongolia) (see para. 10 of this document)
Adjustment for national circumstances	No	Mongolia did not apply an adjustment to its FRL (see para. 14 of this document)
National/subnational	National	Mongolia stated that its FRL covers the entire national territory. However, saxaul forests and shrub were not included in the FRL calculation (see para. 18 of this document)
Activities included	Reducing emissions from deforestation; reducing emissions from forest degradation; and enhancement of forest carbon stocks	Mongolia did not report emissions or removals from the conservation of forest carbon stocks and the sustainable management of forests. However, the Party indicated that the impacts of these activities are considered to be covered by the activities reducing emissions from deforestation, reducing emissions from forest degradation and enhancement of forest carbon stocks (see para. 41 of this document)
Pools included	Above-ground biomass, below-ground biomass, deadwood and litter	See paragraphs 37 and 38 of this document
Gases included	CO_2	The inclusion of non-CO_2 gases was identified as an area for future improvement (see para. 39 of this document)
Forest definition	Included	The definition of forest reported by Mongolia in its modified submission is “all land spanning of at least 1 ha covered by trees with a height of at least 2 m and with a canopy cover of at least 10 percent”. Mongolia clarified that this definition will be used in future national and international submissions (see para. 44 of this document)
Relationship with latest GHG inventory	Methods used for the FRL are not consistent with the latest GHG inventory (covering the period 2005–2014)	The activity data and emission factors used in the FRL and the GHG inventory reported in the first biennial update report of Mongolia are not consistent (see para. 28 of this document)
Description of relevant policies and plans	Included	See paragraph 35 of this document

Main features of the FRL		*Remarks*
Description of assumptions on future changes in policies	Not applicable	
Descriptions of changes to previous FRL	Not applicable	
Future improvements identified	Yes	Several areas for future technical improvement were identified (see paras. 50 and 51 of this document)

Abbreviations: FRL = forest reference level, GHG = greenhouse gas.